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Vertical Forces (Gravity/Other) and Incidental Lateral Component of the Structural Engineering BREADTH Exam Specifications

Effective Beginning with the April 2018 Examinations

- The 4-hour **Vertical Forces (Gravity/Other) and Incidental Lateral** breadth exam is offered in the morning on exam day and focuses on gravity loads. It contains 40 multiple-choice questions.
- The exam uses the US Customary System (USCS) of units.
- The exam is developed with questions that will require a variety of approaches and methodologies, including design, analysis, and application.
- The knowledge areas specified as examples of kinds of knowledge are not exclusive or exhaustive categories.
- Score results are combined with depth exam results for final score of this component.

	Approximate Number of Questions
I. Analysis of Structures	**13**
A. Generation of Loads	5
1. Dead	
2. Live (e.g., occupancy, roof, pedestrian)	
3. Moving (e.g., vehicular, crane)	
4. Impact (e.g., vehicular, crane, elevator)	
5. Vessel collision	
6. Earth pressure	
7. Differential settlement	
8. Hydrostatic/hydrodynamic	
9. Flood	
10. Snow	
11. Rain (i.e., ponding)	
12. Ice	
13. Thermal	
14. Shrinkage	
15. Load combinations	
16. Wind and other loads on bridges	
B. Load Distribution and Analysis Methods	8
1. Static (e.g., determinate and indeterminate, location of forces and moments, free-body diagrams)	
2. Shear and moment diagrams	
3. Code coefficients and tables	
4. Truss analysis methods (i.e., method of sections and/or method of joints)	
5. Approximate beam or truss analysis methods	
6. Approximate frame analysis methods	

7. Influence lines
8. Computer-generated structural analysis techniques (e.g., modeling, interpreting and verifying results)

II. Design and Details of Structures 27

A. General Structural Considerations 3
1. Material properties and standards
2. Construction administration (procedures for correcting nonconforming work, testing methods, inspection methods, structural observation)
3. Environmental considerations (e.g., corrosion, frost depth, sustainability)
4. Serviceability requirements (i.e., deflection, camber, vibration, creep, movement joints)
5. Fatigue (e.g., AASHTO, AISC)
6. Bridge bearings
7. Bridge expansion joints
8. Bridge barriers

B. Structural Systems Integration 2
1. Specifications, quality controls, and coordination with other disciplines
2. Constructability
3. Construction sequencing
4. Strengthening existing systems

C. Structural Steel 5
1. Tension members
2. Columns and compression members
3. Trusses
4. Flexural members (e.g., beams)
5. Plate girders—straight
6. Secondary support systems (e.g., masonry support angles, facade support angles, struts)
7. Shear in steel members
8. Combined axial and flexural members
9. Composite design
10. Bolted connections
11. Welded connections
12. Base plates/bearing plates
13. Thermal effects
14. Bridge piers

D. Cold-Formed Steel 1
1. Framing
2. Connections
3. Web crippling

E. Concrete 5
1. Flexural members (e.g., beams, joists, bridge decks, one-way slabs)
2. Two-way slabs
3. Design for shear (e.g., beam, punching shear, shear friction)
4. Columns and compression members
5. Bridge piers/abutments
6. Walls

7. Prestressed concrete
8. Post-tensioned concrete
9. Composite design
10. Attachment of elements and anchorage to concrete (e.g., inserts, attachment plates, dowels)
11. Crack control

F. Wood 4
1. Beams (i.e., sawn, glued laminated, structural composite/engineered)
2. Columns
3. Bearing walls
4. Trusses
5. Connections (e.g., bolted, nailed, screwed)

G. Masonry 3
1. Flexural members
2. Compression members
3. Flexural-compression members
4. Bearing walls
5. Attachment of elements to masonry

H. Foundations and Retaining Structures 4
1. Use of design pressure coefficients (e.g., active, passive, at rest, bearing, coefficient of friction, cohesion, modulus of sub-grade reaction)
2. Buoyancy effects
3. Retaining walls and abutments
4. Spread footings
5. Combined footings/mat foundations
6. Piles (e.g., concrete, steel, timber)
7. Drilled shafts/drilled piers/caissons
8. Restrained walls (e.g., basement, vault)

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STRUCTURAL ENGINEERING Design Standards[1]

These standards apply to the Vertical and Lateral components of the Structural Engineering exam.

Effective Beginning with the October 2021 Examinations

ABBREVIATION	DESIGN STANDARD TITLE
AASHTO	*AASHTO LRFD Bridge Design Specifications,* 8th edition, American Association of State Highway & Transportation Officials, Washington, DC.
IBC	*International Building Code,* 2018 edition, International Code Council, Falls Church, VA.
ASCE 7	*Minimum Design Loads and Associated Criteria for Buildings and Other Structures,* 2016 edition, American Society of Civil Engineers, Reston, VA.
ACI 318	*Building Code Requirements for Structural Concrete*, 2014 edition, American Concrete Institute, Farmington Hills, MI.
AISC	*Steel Construction Manual,* 15th edition, American Institute of Steel Construction, Chicago, IL.
AISC	*Seismic Design Manual,* 3rd edition, American Institute of Steel Construction, Chicago, IL.
AISI S100	*North American Specification for the Design of Cold-Formed Steel Structural Members*, 2016 edition, with AISI S240-15 and AISI S400-15/S1-16, American Iron and Steel Institute, Washington, DC.
NDS	*National Design Specification for Wood Construction* with *NDS Supplement: Design Values for Wood Construction,* 2018 edition, American Wood Council, Leesburg, VA.
NDS	*Special Design Provisions for Wind and Seismic,* 2015 edition, American Wood Council, Leesburg, VA.
TMS 402/602	*Building Code Requirements and Specification for Masonry Structures,* 2016 edition, The Masonry Society, Longmont, CO.

Notes

1. Solutions to exam questions that reference a standard of practice are scored based on this list. Solutions based on other editions or standards will not receive credit. All questions use the US Customary System (USCS) of units.